MEASURING LEAD CONTAMINATION IN ALL HOMES AND INTERIOR CLEANUPS OF ALL HOMES WITHIN THE BUNKER HILL SUPERFUND SITE.

Dr. John F. Rosen
Professor of Pediatrics
Head, Division of Environmental Sciences
The Children's Hospital at Montefiore
The Albert Einstein College of Medicine
Bronx, New York 10467

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General - Summary

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1. INTRODUCTION:

The Bunker Hill Superfund site is one of the largest and costliest ($300 million) in the nation. It is the site of the mine, smelter and refinery that operated from 1880 to 1981. In the early 1970s investigations of the Kellogg community uncovered evidence of severe human exposures to site contaminants, primarily, numerous cases of high blood levels in children. In fact, the highest blood lead values ever recorded in United States of ages from infancy through adulthood were found in Kellogg at this time. The Bunker Hill site was placed on the Superfund National Priority List for cleanup in 1981.

Today, threats to children, women of childbearing age, pregnant women and the elderly, are undeniable and unacceptable. In 1998, elevated lead levels were found in 19.7 percent of children under six years of age. All of these children were voluntarily screened by "grab" sampling methodology, a method which does not follow the scientific foundations of an epidemiologic assessment of representative children from the entire community. Nonetheless, even by this unscientific technique, **all children in Kellogg and in all towns within the "***box***" through 6 years of age, qualify for universal blood lead screening annually or, preferably, semi-annually**. Despite this high prevalence of lead poisoning in young children and abundant evidence of medically affected teen-agers and adults, not one of the residents from this community has ever been treated medically, diagnosed, or followed by accepted medical monitoring-treatment programs for excessive lead exposure. This paradigm of medical monitoring-surveillance should address immediate health care needs, as well as latent adverse health effects of lead, which have been documented in the peer-reviewed literature.

For the past several decades, contaminants, such as lead, cadmium, arsenic, zinc, and mercury, have accumulated in the homes of Superfund residents. Thus, clothes, furniture, kitchen cabinets, rugs, floors, children's toys, attics(particularly, as archived heavy metal contamination), basements, window sills, window wells, and all wooded surfaces(the ENTIRE HOME ENVIRONMENT) have accumulated toxic amounts of the metals cited above. Undisputable evidence, although suboptimal methods were employed, definitively demonstrated that Kellogg homes and others in the "box"were grossly contaminated with metal toxicants; and to meet all basic public health principles to ensure the health of this community, it is mandatory that all homes within the Superfund Site be cleaned to remove these toxicants, according to the protocol outlined below. Until this task is completely and expertly accomplished with a high level of professionalism, residents in the Superfund Site will continue indefinitely to be exposed to various toxic metals within their interior (home) environments. Priority is to be given first for Pb home measurements and home clean-ups for all homes within the current Superfund site. Once this task has begun in all aspects, described below, a similar program should then be initiated promptly for homes in the entire Coeur d'Alene River Basin.

(*The "box," throughout this text, is meant to include all homes in the current Superfund site as the initial priority. The "box" also includes all homes in the Coeur d'Alene River Basin as the second critical priority.***)**

II. RATIONALE FOR THIS PROTOCOL(Millar and Mushak, 1982;Farfel and Chisolm, 1990; Farfel and Chisolm, 1991; Farfel et al., 1994; Farfel et al., 1994; Lanphear et al., 1995; US EPA, 1995; Adgate et al., 1995; Lanphear et al., 1996; Lanphear et al., 1996; Lanphear et al., 1996; Lanphear and Roghmann, 1997; Edmond et al., 1997; Lanphear et al., 1997; Lanphear et al., 1998; Lanphear et al., 1998; Sterling et al., 1999.)

**The residential home interiors of this Superfund site have never been thoroughly assessed for the level of interior contamination; nor has there yet been any intensive effort to cleanup all homes within the "box" as of this writing.

**The prior approach to cleanup by the IDDHW(1991) can only be considered, at best, a feasibility pilot study. Since that time, numerous articles, including documents from the US EPA, have been published in the peer-reviewed literature, which, collectively, provide specific guidance on how such interior cleanups should be carried out.

**Those data, reported by the IDDHW in 1991, lack scientific credibility and are totally outdated by new information(see below).

****Without strict interior home cleanups, developed over the past decade(cited above), it now the responsibility of the US EPA to employ these methods for residential cleanups on an annual basis to ensure the health of all residents of this community. According to the general paradigms of cleanup procedures, it is mandatory that strict and scientifically sound methods be employed NOW for long over-due interior remediation.**

**Scientifically sound methods are NOW available(and have been for several years) for residential cleanups; and it is both disappointing and disturbing that this endeavor has not been accomplished annually, as millions of taxpayer dollars have been spent on an exterior cleanup– an exterior cleanup whose basic principles and methods are now open to very serious question.

**The most serious shortcomings of IDDHW's 1991 "pilot project" is that no decisions were made as to the methodologies for cleanup, which were first described in the literature in 1982; and the data presented by EPA at that time were out-dated and very poorly assessed by any reasonable degree of scientific foundation to ensure the health of the community(see below).

****Health benefits derived from annually interior cleanups are irrefutable, if carried out by strict environmentally sound methods.**

****The *pilot protocol* for cleanups, recently presented by the *Terragraphics Company*, is inadequate and returns interior home cleanups to a superficial and undocumented and unscientific approach, which is unsupported by the studies cited in this Bibliography. *The methodologies, proposed by the Terragraphics Company, do not meet current standards in the field and, thus, will not benefit the health of this community(SEE BELOW).***

III. PATHWAYS THAT LEAD TO CONTAMINATION OF HOMES:

The pathways to lead contaminated homes are obvious; and these pathways will be summarized briefly. The contributions to lead-contaminated homes, directly into household dust, that entirely pervades every aspect of a home's living environment, to floors, rugs, clothes, skin, toys, hair, scalp, linoleum, wooded surfaces, ceilings, walls, attics, kitchen ware, kitchen appliances, attics...include(not exclusively), exterior soil and dust from yards, cross-contamination from a neighbor's yard, walking into homes with shoes and all clothing

contaminated from in the external world during exterior remediation, dust storms, local flooding, uncovered and uncontrolled contaminated soil from the Superfund site and airborne lead particles from Superfund operations. From a public health point of view, it is untenable that air monitoring on and off site has been carried out(at best) periodically. The fact that the schools have been directly hit by dust storms from the Superfund site, even during outside school sports activities, is one of numerous examples of an "operation" out of control–at the expense of young teen-agers and younger children.

Several analyses have been carried out to estimate the contributions to lead-contaminated house dust and soil to people's homes and ultimately as a major source of lead exposure and poisoning of young children(see above references). The pooled analysis of 12 epidemiologic studies demonstrated that lead-contaminated house dust, with or without normal hand-to-mouth activity in children 1-6 years of age and teen-agers and adults, is the major source of lead exposure for children(20). This and other studies(cited above) further demonstrate the very strong relationship between interior dust lead loading and children's blood lead values. Clearly, site-specific factors, such as the external remediation in Bunker Hill, the weather, nutrition and the life-styles of the community are critical factors that influence blood lead values at a given level of exposure. Structural equation modeling has also been used to definitively characterize pathways of lead intake by young children, ultimately leading to elevations in blood lead values(Lanphear and Roghmann, 1997). These and other data demonstrated that dust lead levels in the home were directly and indirectly related to blood lead levels via ***HAND LEAD***(Lanphear and Roghmann, 1997; Lanphear et al., 1998; Sterling et al., 1999). As noted earlier, mouthing behaviors of young children are a critical factor towards excessive lead exposure in young children.

It can be concluded that EPA and the state of Idaho never pursued a course of investigation or remediation to strictly control ingestion and inhalation of contaminated house dust. Active and continuous hazard reduction in people's homes, with their relocation to safe environments during home cleanups, has never been carried out during the many years of the external "cleanup." Data, collected to date, fail to provide any protection of homes and those who reside in them, although pathways of excessive lead exposure are obvious. ***Thus, there is no reason to ACCEPT OR TRUST EPA(REGION 10)-IDAHO data that declining lead levels in household dust and children's blood values reflects successful remediation operations or basic paradigms of human health risk assessment.***

IV. BIOAVAILABILITY OF LEAD IN HOUSEHOLD DUST.

The bioavailability of lead from household dust has been unequivocally demonstrated: The resting pH of gastric juice in children is about 1.0; and sustainable gastric acid output with stimulation approaches 150 milli-equivalents per liter (Konturek, 1981). In addition to hydrochloric acid, the gastric contents also contains multiple enzymes and other electrolytes. The complex interactions of the gastrointestinal tract with lead are shown in the in vivo behavior of various chemical forms of lead. Lead sulfide, for example, a chemical form of lead considered to be less bioavailable than the chloride, sulfate or organ chelates, has a solubility product constant (KSP) of 3.4×10^{-28}; but is extensively solubilized by acidic gastric juice to lead chloride, KSP = 10^{-4} (Healy et al., 1982). Thus, this type of reactivity with gastric juices and contents (enzymes) plays a highly significant role in the bioavailability of various lead species. Moreover, it has already been demonstrated in adults that lead sulfide, ingested during the fasting state or with meals, was absorbed in the same amount as lead chloride or the cysteine complex .

Additional studies (Mushak, 1991) have also shown the particle size plays an important role in the absorption of lead from the gastrointestinal tract: particle sizes less than 100 microns, especially less than 50 microns, markedly enhance the absorption of lead (Bornschein et al., 1989; Duggan et al., 1985). In terms of lead in soil and dust, studies have shown that for each 1000 ppm concentration of lead, the increase in the blood lead values of children raises on average by 3.5-5 µg/dl (CDC, 1991; Bornschein et al., 1986; Bornschein et al., 1989; Clark et al., 1987; Gallacher et al., 1984). Young children are at further risk as a result of normal hand-to-mouth activity, as related to particle sizes of lead in various media, including small particles of lead-based paint in household dust. The latter type of exposure is the most common pathway for children to develop lead poisoning. It has been demonstrated that lead at particle sizes <200 microns, adheres most avidly to the skin of children (Bornschein et al., 1986; Bornschein et al., 1989; Clark et al., 1987; Duggan et al., 1985). Collectively, therefore, lead contamination or household dust poses a substantial health risk for Kellogg's Children.

V. THE PROTOCOL(BASED UPON ALL REFERENCES IN SECTION II).

A. GENERAL PROCEDURES:

**The general design of the home cleanups is longitudinal to be carried out on an annual basis until the exterior cleanup is totally completed. Alternatively each year, sampling of households for lead will be carried out in the summer; and the next year, on a rotating basis, in the warm summer months.

****Prior to and after the cleanups, every home will be sampled for lead according to the specifics of this protocol outlined below. Any home, that does not meet HUD cleanup lead values will be remediated again within a turn-around time no longer than six weeks.**

**Commercial companies are precluded from this protocol for several reasons. The two most important ones are that commercial companies do not have the expertise in carrying out interior cleanups of this type. The second consideration is that those carrying out the work must be thoroughly trained by national experts(see below) and should be fully trained members of the Kellogg community.

In this regard, the Terragraphics Company has no track-record in carrying out interior cleanups(see below); **as a result, this company, with its own inherent conflict of interests, is precluded from participating in any aspect of home cleanups.

**Similarly, the Panhandle Health Department is also precluded from participating in the household sampling and cleanups for similar reasons noted above for the Terragraphics Co.

****Training of work crews will be carried out by a nationally recognized expert in this field, such as Drs. B. Lanphear(University of Cincinnati) or M. Farfel(The Kennedy Kreiger Institute in Baltimore). As part of this training program, each "work crew" will have a supervisor who is randomly chosen without any "ties" to any member of their individual work group.**

**All homes, now or in the future in the "box" are required to be remediated. No exceptions to these inclusion criteria are acceptable.

**Tyvex suits, gloves and booties are to be worn by all workers carrying these tasks; and these are to be discarded for new ones for each home. New gloves, all without talc, are to be used for each new sampling area. The old pair of gloves should be collected, bagged and discarded.

**Similarly, a newly cleaned HEPA VAC is to be used for each home. A HEPA VAC cannot be used across homes, unless thoroughly cleaned prior to use.

**Rugs and all upholstered items in good condition will undergo the cleaning protocol outlined below--unless these items are in very poor shape. Under these circumstance, the homeowners will be given funds, the equivalent of the cleanup costs of these items, to purchase replacements.

**Commercially available wipes(from KMART) or their equivalent, without aloe, will be used to sample all walls, wooded surfaces, and linoleum.

***Either BRMs(Baltimore Repair Maintenance Vacuums)--to be obtained from Dr. Farfel or* commercially available HVS3 Vacuums will be used for all upholstery cleaning and lead sampling.

****The hands of all children 7 years of age or less will also be sampled with wipes for lead measurements.**

**Other areas to be included are: attics, basements, play areas, entry way floors, exterior entry way, all interior window wells, windows, underneath all kitchen appliances, all children's rooms, heating ducts and all air conditioners. Room samples will be obtained at their mid-points. If there are no children living in a home, the most commonly used interior rooms will substitute for play areas.

**A questionnaire will be developed that includes a total input of the demographics of each individual home and its residents therein: ages, sex, years in Kellogg, occupation, health symptoms, distance from original stack, SES, Hollingshead Four Factor Scale, yard remediation done or not, if so, how long ago.....*THIS QUESTIONNAIRE WILL PROVIDE A DETAILED SUMMARY, WHEN COMPILED, OF KELLOGG'S DEMOGRAPHICS. THIS BASIC INFORMATION IS CURRENTLY UNAVAILABLE.* The questionnaire will be written by Dr. John F. Rosen, based upon a questionnaire that has been used by him and validated at two other Superfund sites. The Community Lead Health Project(CLHP) will have the responsibility to collect these data; and the CHLP will be appropriately funded to complete this task.

**ANALYTICAL PRINCIPLES:

** All measurements for lead in home samples will first be measured by flame atomic absorption spectroscopy(AAS). If a sample, by flame analysis, *is less than 10 micrograms, graphite furnace AAS (GFAAS)will then be used to measure the sample.*

**NIST leaded dust standards will be obtained from NIST; and the Supervisor of each work crew will be taught to "spike" an unknown for laboratory QA/QC considerations after every 10 samples are obtained. Similarly, after every 10 samples, a blank will be placed in a 50 ml centrifuge tube, for collection of all wipes and vacuum samples, for laboratory QA/QC analyses.

**For digestion of samples, 1 normal hydrochloric acid will be employed.

**Obviously, chain of custody methods will be taught to each work group by the national expert; and data will be reviewed periodically by the PEER-REVIEW TEAM.

**Air filtration systems will be placed throughout each home in every window that is ever opened by the home resident.

**THE PEER-REVIEW TEAM:

**This TEAM consist of Drs. Bruce Lanphear and M. Farfel(pending their agreement) in addition to Ms.B. Miller and Ms. Jeanie Smith(pending their agreement).

**Furthermore, this protocol will be reviewed by the PEER-REVIEW TEAM ; and modifications will be made in the initial protocol, as described herein, as deemed to be appropriate.

****Each family will receive the results of home lead measurements prior to and after cleanup within 6 weeks of the work. These data will be transmitted by hard copy, after review by the Peer-Review Team to ensure that HUD cleanup standards have been met or exceeded.**

B: <u>OTHER SPECIFICS OF THE CLEANUP METHODS</u>.

**For interior sampling for lead pre-and post-cleanup, the wipes specified above will be used; and no more than 3 wipes would then be placed in 50 ml centrifuge tubes(polystyrene-purchased from the Corning Company).

****For interior cleanups of all wooded smooth surfaces, including walls, attics and ceilings, floors, window seats, windows...new rags will be used for each home and for each room or space within a home and then bagged and discarded. The rags should be moistened in a damp not wet condition with a solution containing one pound of dry Calgon dishwasher detergent in 5 gallons of hot water.**

****One square foot disposable templates will be used for all sampling.**

**Samples of household dust from upholstered areas will be obtained using either a BRM or HVS3 vacuum. Collection of these samples are specified for each type of vacuum.

**For cleaning of all upholstery(rugs, furniture), "steamex" type of cleaners will be purchased; these will contain one pound of calgon per 5 gallons of hot water. The water will be discarded periodically according to its color(of dirt), as determined by the PEER-REVIEW TEAM..

C. <u>TIME SCHEDULES FOR CLEANING AND RELOCATION OF FAMILIES</u>.

****THIS IS THE TIMELINE TO BE EMPLOYED FOR EVERY HOME AND FAMILY IN KELLOGG; AND NO FAMILY IS PERMITTED TO VISIT OR ENTER THEIR HOME UNTIL THE TIMELINE, OUTLINED BELOW, HAS BEEN COMPLETED:**

****MINUS DAYS 3-5:** The questionnaire will be filled out during an interview with the family; and all procedures to be carried out in each Superfund home will be explained in detail.

****DAY 1: Sample home for lead. *<u>THEN HEPA VAC entire home starting in the attic and working down to finish in the basement. This work plan, from the top to bottom of each home, is to be carried out for this ENTIRE PROTOCOL(MILLAR AND MUSHAK, 1982).</u>***

****DAY 2: Damp wash entire home with combination of rags and "steamex" equipment, as noted above.**

****DAY 3: "REST DAY" for home to completely.**

**DAY 4: *HEPA VAC ENTIRE HOME FROM ATTIC TO BASEMENT–FROM "TOP DOWN" IN ALL HOUSES.*

**DAY 5: Damp wash entire home as carried out on DAY 2.

**DAY 6: *DRYING OF ALL SURFACES. NO ENTRY BY ANYONE. ALL WINDOWS CLOSED AND THESE ARE TO REMAIN CLOSED THROUGH DAYS 1-6, UNTIL AIR FILTRATION UNITS ARE IN PLACE.*

DAY 7: Post-cleanup sampling obtained by wipes and BRM/HVS3. The family can then move back into their home after the post-cleanup sampling has been completed in the late afternoon or early evening.

To repeat, if post-cleanup lead values fail to meet HUD standards, all procedures from DAYS 1 THROUGH 7 MUST BE REPEATED WITHIN 6 WEEKS OF THE RECEIPT OF THESE DATA.

DATA AND PROTOCOLS FROM THE IDAHO DEPARTMENT OF HEALTH AND WELFARE-IDDHW (1991) AND THE TERRAGRAPHICS COMPANY(JUNE, 1999).

IDDHW, 1991.

This ***PILOT STUDY*** is out-dated and totally fails to provide any substantial guidance on sampling for lead in homes and the methods to cleanup homes. As a ***PILOT STUDY***, it is limited in scope, methods to be used, and relevance to public health paradigms. This document fails to present a **viable conclusions/consensus concerning methods, limited number of homes were tested, and those that were tested were done so unscientifically. The database, provided in this pilot study, *currently*, has virtually no relevance to what is now known to be needed in the homes within the Superfund site to serve the interests of public health.**

TERRAGRAPHICS COMPANY-JUNE, 1999.

1.**The Terragraphics Company's(TG) "protocol" suffers, in general, from a similar lack of scientific underpinnings as those in EPA's 1991 document.

2.**TG has NO track record in the peer-reviewed literature on lead sampling of homes and their cleanup. From this critical standpoint, they do not have the qualifications necessary to carry out sampling or cleanups of homes.

3.**TG has an unequivocal conflict of interest in proposing to carry out this work, because they have been and still are a major contractor for the Superfund cleanup, because of their close ties to the Panhandle Health Department, which lacks expertise in virtually all public health

paradigms to assess the prevalence of childhood lead poisoning in Kellogg, and because the Panhandle Health Department itself has no established expertise in home sampling and cleanup methodologies. **These three items(LISTED ABOVE)** ***exclude TG from undertaking household sampling and home cleanups.***

4.TG's 1999 protocol reflects substantial weaknesses, which, together with items 1-3 above, exclude its participation in the long overdue home sampling and cleanups in Kellogg and in all the other towns within the "box." Some of these weaknesses are outlined below.**

5.The entire scope of TG's 1999 protocol is to carry out a pilot project in Smelterville in selected homes.** This proposal totally ignores all the public health needs of all the towns within the Superfund site. **Furthermore, the methods have been well worked out(see the attached bibliography) for interior lead sampling and interior lead cleanups thereby making it entirely unnecessary for any pilot project to be carried out in Smelterville or any other isolated town within the whole Superfund site. In short, in view of current knowledge in the year of 2000, it is a waste of time and money to focus entirely on any pilot project.**

The real need is to apply techniques, that are now well established, to sample and cleanup ALL HOMES NOW IN THE SUPERFUND SITE. UNTIL THE LATTER ENDEAVOR IS STARTED, THE PUBLIC HEALTH NEEDS OF ALL RESIDENTS IN THE ENTIRE SUPERFUND SITE ARE BEING IGNORED.

TG's entire focus on a "pilot study" in Smelterville will further delay the health needs of all people living today within the Superfund site. To ignore this basic principle is unsound scientifically and medically and environmentally.

6.**All lead analyses in this pilot study are being carried out by flame AAS; and it is obvious that **hand leads of children, a major pathway of exposure, are being excluded.** This is a major shortcoming of an unnecessary pilot endeavor. To measure hand lead, in most instances, it is necessary to employ GFAAS. Furthermore, the detection limits and relative standard deviations of the flame AAS instrument are not specified nor are those for GFAAS methods.

7. The only reference from the peer-reviewed literature, cited in this text, is one article by Dr. M. Farfel. Why have references to an extensive literature not been included in TG's proposed pilot project?

8. Vacuum bag sampling of homes is a scientifically archaic method to measure lead contamination in Superfund homes, as proposed in the unnecessary TG pilot study.

SUMMARY:

There is a critical public health need at this SUPERFUND SITE for sampling of all homes for lead and comprehensive cleanups of all homes in the "box," as defined above to include, ultimately, the CDA RIVER BASIN, in addition to installing air filtration systems in all windows. Although external remediation has been on-going for many years, the failure to cleanup home interiors, *according to currently available and accepted methods*, is another example of the disregard of people's health within this Superfund site AND the CDA RIVER BASIN. Until these health needs are met, excessive exposure to lead and its adverse health effects place all residents of this SUPERFUND SITE AND THE CDA RIVER BASIN at high(dread) risk for augmenting or developing dire health consequences as the result of on-going exposure to a very potent toxicant.

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FYI

FAX

Ann 10

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To:	**From:**
Rob Hanson, DEQ IDAHO	Harve & Tina Paddock
	Squirt Irrigation
	325 NW 9th Street
	McMinnville OR
	97128
Phone	***Phone*** +1(503)472-9282
Fax Phone (208)373-0154	***Fax Phone*** +1(503)472-9282

REMARKS:

Attached is the protocol for interior abatement provided by John Rosen, MD, Professor of Pediatrics, Head, Division of Environmental Sciences, Montefiore Medical Center, Bronx, New York.

Please consider this protocol for the ongoing testing on the schools in the Coeur d'Alene River Basin.

Thank you.

cc: Ann Williamson, EPA Region 10 206-553-0124
Chuck Findley, EPA Region 10 206-553-1809
Robert Martin, National Ombudsman 202-401-1740
Robert Huntley, Attorney at Law 208-388-0234